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The University of Chicago

PRICE DIFFERENTIALS IN WHEAT
FUTURES BETWEEN KANSAS
CITY AND CHICAGO

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CHAPTER I

INTRODUCTION

PURPOSE OF THE STUDY

This study investigates the factors that cause wheat prices to fluctuate, relative to each other, in the large terminal markets.¹

A relatively small number of commodity exchanges,² international in scope, dominate the world-market by means of their spot and futures quotations as well as by their operations in arbitrage.³ The quotations of these exchanges are closely followed by every substantial dealer or trader who is interested in the particular commodity which is dealt in by each exchange.

Wheat is the greatest of all the commodities with which the exchanges deal.⁴ This important commodity, from a marketing point of view, presents many unusual problems which are worthy of critical analysis. One of the most intricate of these problems, and the one chosen for this study, is that which is concerned with those price relationships between the different grain exchanges known as "inter-market spreading."

Inter-market spreading differs from ordinary speculative operations in that the spreader is interested, not in changes in price on the same market, but in changes in the price-spread between different markets. The spreading operator reaps a

¹ The major part of the investigation is limited to the study of the spreads in futures between Kansas City and Chicago.

² Chicago, Kansas City, and Minneapolis are the principal grain exchanges in the United States.

³ L. B. Zapolon, "International and Domestic Commodities and the Theory of Prices," *Quarterly Journal of Economics*, XLV (May, 1931), 417.

⁴ Other commodities having a greater monetary value are not so important for human consumption.

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profit or loss from these changes in prices in the one market relative to changes in price in another market in which the spreader is operating simultaneously.

The change in price in one market relative to another market is due to demand and supply factors which affect the two markets in different degrees. It is the purpose of this study to try to discover what these factors are and to arrive at conclusions as to the relative importance of each.

The investigation will be limited to a few of the larger grain markets, the chief of which are Chicago, Kansas City, and Minneapolis.

Kansas City represents a hard winter-wheat market and naturally reflects the demand and supply situation in hard winter-wheat territory. On the other hand Minneapolis represents a spring-wheat market and reflects the supply and demand situation in spring-wheat territory. Chicago is representative of all the different classes of wheat, and it is usually customary for the class which is most plentiful to be delivered on contracts at Chicago.

Kansas City and Minneapolis have a relatively small volume of futures trading. Chicago trading normally constitutes between eighty-five and ninety per cent of the total futures trading in the United States. The volume of futures trading in the four markets of Chicago, Minneapolis, Kansas City, and Duluth comprises on the average over ninety-six per cent of all the futures trading in the United States.⁵

Both Kansas City and Minneapolis are located in surplus producing sections⁶ with large quantities of the wheat normally flowing through Chicago on its way for export.⁷

⁵ "Reports by Members of Grain Futures Exchanges," *Senate Document No. 264*, Part I, p. 16.

⁶ There might be a question as to whether Minneapolis is located in a surplus producing section since most of the bread-wheat in the Minneapolis section is ordinarily milled into flour before being shipped out.

⁷ See the chapter on transportation for other important outlets.

This wheat moves rather steadily outward along the great transportation routes, both by rail and by water, and the price in Kansas City or Minneapolis bears a somewhat regular and constant relationship to Liverpool prices. Both Kansas City and Minneapolis sell outward in every direction, and the wheat moves toward whatever place will yield the highest price (net at point of shipment) or until the prices netted by sales to various destinations come to equilibrium.⁸

For the purpose of interpretation an attempt will be made to analyze the effect of the following factors upon the price-spreads between the different grain exchanges:

- I. Constant factors
 - A. Deliverable grades
 - B. Freight rates (rail and ocean rates, etc.)
- II. Variable factors
 - A. Supply (size of crop, receipts of wheat, etc.)
 - B. Demand (variations in demand due to quality, export demand, demand from millers, etc.)

DATA OF PRICES

Price data for the present study were obtained from the annual reports of the different grain exchanges and from the trade journals. The sources of the data are as follows:

1. Annual Reports of the Chicago Board of Trade, 1901-30.
2. Annual Reports of the Kansas City Board of Trade, 1910-30.
3. Annual Reports of the Minneapolis Chamber of Commerce, 1910-30.
4. *The Daily Trade Bulletin*, published by Howard Bartells and Company, Chicago, 1901-29.

Ocean and freight rates, data for correlation, etc., were obtained from other sources not listed above.

Spreads were computed between the three principal futures markets in the United States: Chicago, Minneapolis, and Kansas City. The spreading picture is somewhat more simple be-

⁸ Frank Albert Fetter, *The Masquerade of Monopoly* (New York: Harcourt, Brace & Co., 1931), p. 296.

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tween Kansas City and Chicago than between Minneapolis and Chicago, and for this reason the major part of the study was confined to the Kansas City-Chicago spread.

In all, six spreads were computed. Four of these were between Kansas City and Chicago, for the May, July, September, and December options. One spread was computed between Minneapolis and Chicago, and one between Winnipeg and Chicago. These were both for the May option. No spreads were computed between Liverpool and Chicago.

The spreads as computed are fairly representative of the different varieties of wheat in the United States and Canada. It is impossible to thoroughly understand the relationship between Kansas City and Chicago or between Minneapolis and Chicago without having a comprehensive view of the whole wheat situation in North America. There are three principal wheat growing territories on the North American continent: the winter-wheat belt, which includes Kansas, Northern Oklahoma, Northern Texas, Southern Nebraska, and eastern Colorado; the spring-wheat belt, which includes Minnesota, North and South Dakota, and Montana; and the Canadian belt, which includes the provinces of Manitoba, Saskatchewan, and Alberta.⁹ There is also some wheat raised for export on the Pacific coast but there is not a great amount of inter-market spreading between this section and that farther east.

THE COMPUTED SPREADS

The annual averages for the six spreads as computed are shown in Table I and the accompanying charts (Figs. 1 and 2). The graphic representation of the monthly data is also shown in Figure 3. The spread differences are shown in cents per bushel. The normal relationship is for the prices in Kansas City and Minneapolis to be lower than the price in Chicago,

⁹ See testimony of Clyde M. Reed, at the Chicago Hearing of I.C.C. Rate Structure Investigation, No. 17,000 (1927), Part VII.

and for this reason the signs are regarded as positive when the prices in those markets are below the Chicago price and as negative when the prices in those markets are above the price

TABLE I
ANNUAL AVERAGES FOR THE SIX SPREADS*
(In Cents per Bushel)

KANSAS CITY-CHICAGO SPREAD					MINNEAPOLIS-CHICAGO SPREAD	WINNIPEG-CHICAGO SPREAD
Year†	May	July	September	December	May Option	May Option
1902.....	2.880	.....	.....	.....	.....	.....
1903.....	8.972	.....	.....	.....	.....	.....
1904.....	12.122	.....	.....	.....	.....	.....
1905.....	11.176	.....	.....	.....	.....	.....
1906.....	6.908	.....	.....	.....	.....	.....
1907.....	6.386	.....	.....	.....	.....	.....
1908.....	4.518	.....	.....	.....	.....	.....
1909.....	6.438	.....	.....	.....	.....	.....
1910.....	5.205	5.527	3.883	2.849	1.030	8.344
1911.....	4.001	4.058	3.770	0.724	7.491	0.006
1912.....	1.851	4.881	5.177	5.484	5.189	2.695
1913.....	5.460	5.801	5.409	4.286	4.644	3.545
1914.....	5.229	5.503	5.406	6.879	3.077	1.890
1915.....	7.304	5.907	4.427	4.998	4.463	— 0.324
1916.....	6.935	6.280	5.219	2.391	1.378	1.136
1917.....	1.245	0.526	2.136	.....	—3.062	— 1.846
1918.....	.....	.....	.....	.....	.....	.....
1919.....	.....	.....	.....	.....	.....	.....
1920.....	.....	.....	.....	4.698	.....	.....
1921.....	6.790	8.122	9.980	8.128	7.875	—28.290
1922.....	9.766	6.951	7.228	7.624	—6.552	1.062
1923.....	7.770	7.249	5.644	4.456	0.529	5.909
1924.....	5.286	7.153	8.273	8.535	—5.323	6.497
1925.....	8.492	7.451	3.930	1.389	4.885	— 5.982
1926.....	4.419	7.865	7.101	5.931	3.454	10.577
1927.....	6.729	7.772	7.184	6.033	—0.738	— 0.329
1928.....	6.232	7.554	7.530	6.729	4.711	— 1.293
1929.....	6.887	7.727	6.660	5.819	4.447	— 2.288

* Minus signs indicate that the average price in the less active market is higher than the average price in Chicago. Where no sign is given the Chicago price is higher than that in the less active market.

† Dates are for the year which includes month of delivery. Data of spreads are logically arranged with that of the July spread following the preceding May, etc. This method of arranging the dates is followed in all the tables unless otherwise specified.

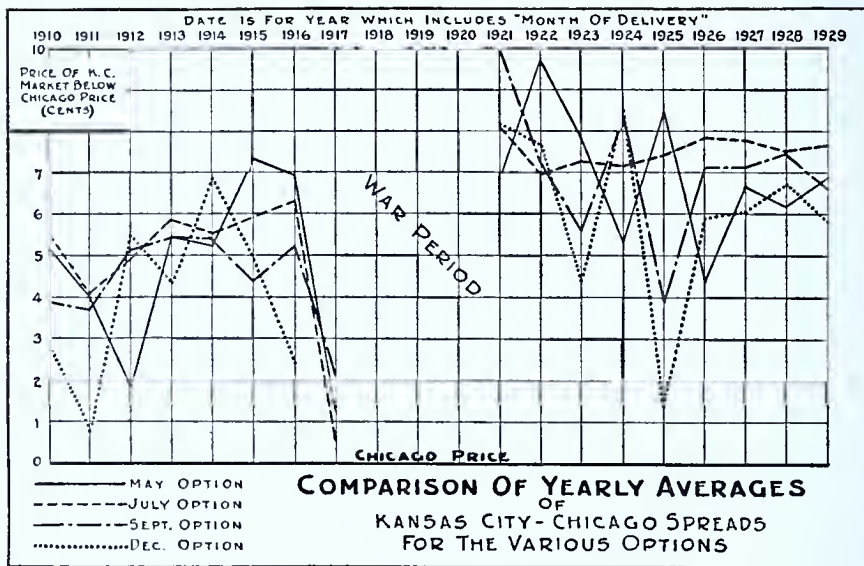


FIG. 1

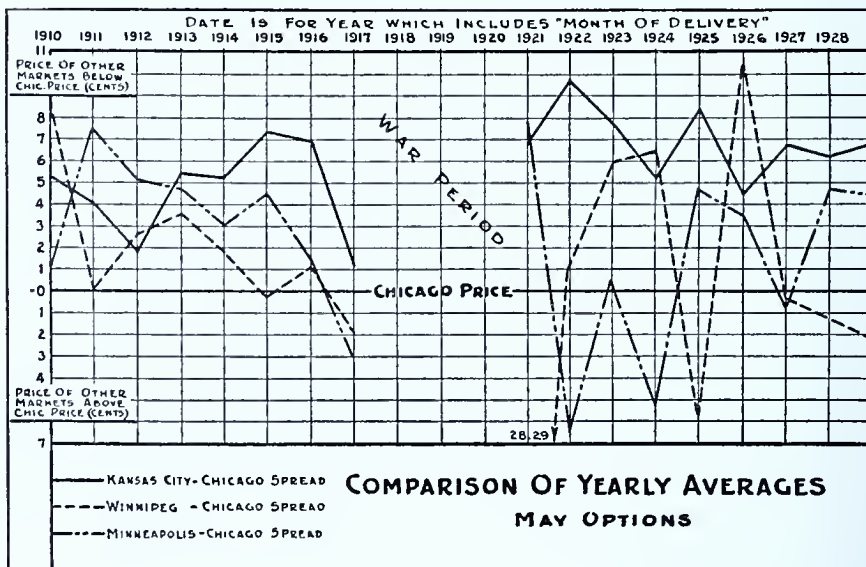


FIG. 2

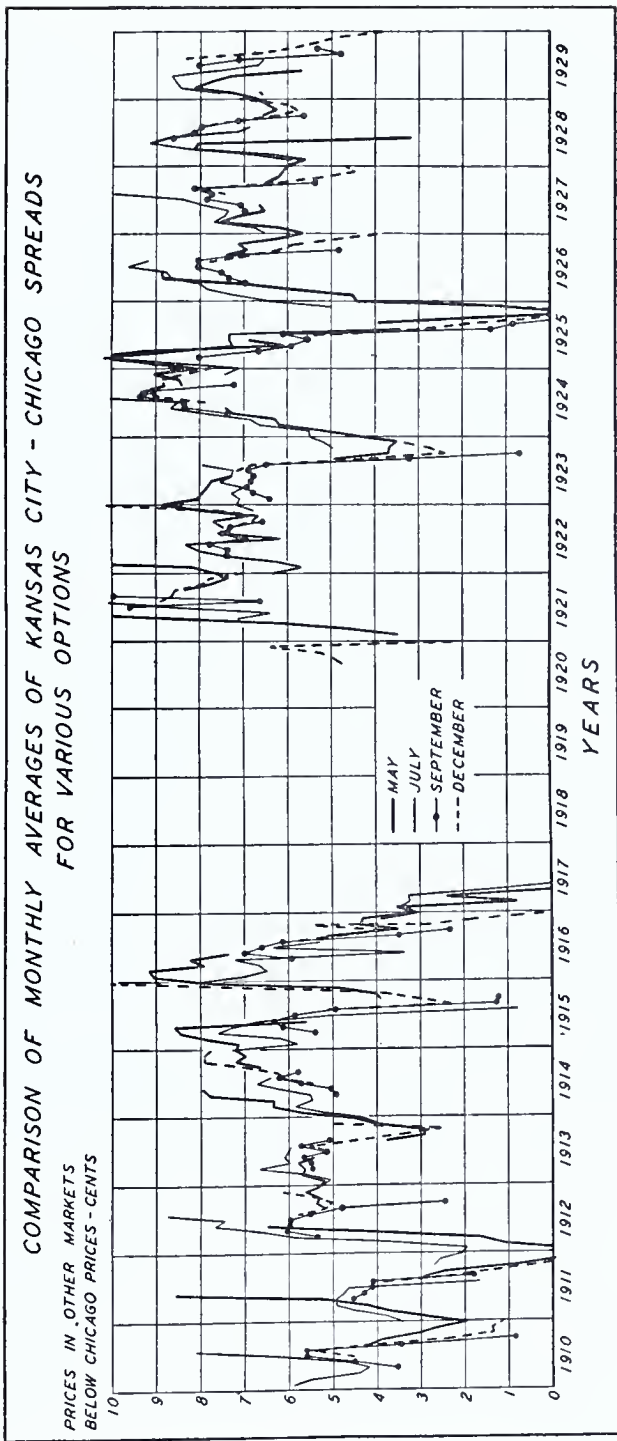


FIG. 3

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in Chicago. This method of designating the signs causes an inverted picture with respect to the charts, but this inconven-

TABLE II
MONTHLY AVERAGES OF THE SIX SPREADS
(1910-1929)
(Cents per Bushel)

MONTH*	KANSAS CITY-CHICAGO SPREAD				MINNE- APOLIS- CHICAGO SPREAD	WINNI- PEG- CHICAGO SPREAD
	May	July	Septem- ber	Decem- ber	May Op- tion	May Op- tion
January.....	5.66	5.77	.....	.....	0.48	0.19
February.....	6.47	6.34	.....	.....	1.61	0.11
March.....	6.81	6.67	.....	.....	1.30	0.89
April.....	6.62	6.75	5.69	.....	1.42	-1.75
May.....	6.39	6.34	6.12	.....	3.26	-2.51
June.....	.....	6.33	6.80	5.85	.....	.....
July.....	.....	6.12	6.29	6.52	.....	.....
August.....	.....	.....	5.39	5.54	.....	.....
September.....	5.24	.....	3.28	4.86	.....	.....
October.....	4.84	.....	.....	4.37	-2.43	2.71
November.....	5.02	.....	.....	4.65	-0.72	2.74
December.....	5.42	5.56	.....	4.76	0.06	2.23

* All of the January's for each of the spreads were first averaged, then all the February's, and so on until a simple arithmetic average was obtained for all the active trading months in a particular option.

ience is much more than overbalanced by the fact that it is much easier to work with positive signs than with negative signs.

CHAPTER II

ECONOMIC ASPECTS OF SPREADING

RELATION OF SPREADING TO EQUILIBRIUM

If the price changes in two competitive markets were simultaneous, in the same direction, and for the same amount, the two markets could be regarded as being in a state of price equilibrium. Under such circumstances the two markets would always be "in line" with each other.

If this condition were to exist between two competitive markets it would be necessary for the transportation services between the two markets to work smoothly and efficiently and for the costs to remain stationary. It would also be necessary for an army of buyers, sellers, speculators, and traders, possessing domestic and foreign connections, and all alert to any opportunities of profit arising out of any price differences, to be in readiness to take advantage of all changes in price. These buyers and sellers would be operating simultaneously in both of the competitive markets and their interchange of bids and offers would be one of the means of maintaining the markets in stable equilibrium. Their means of transmitting these bids and offers would be by cable, telephone, telegraph, wireless, and personal contact. The news of crop forecasts and of accumulating or dwindling stocks would thus be transmitted immediately to all those interested. Any movement of the commodity that was necessary to keep the markets properly balanced would take place with a high degree of rapidity and smoothness. The standards for grading the commodity would have a high degree of perfection and the different grades, once determined, would be unalterable and unquestioned.

It is the supply and demand factors that disturb the equilibrium.
—The ideal market situation is presented above. No such sit-

uation ever exists and no two markets are ever in a state of perfect equilibrium. Instead, the equilibrium of the different markets is being continually disturbed because of changes in demand and supply affecting one or more of the markets and not reflected in the others, at least, not in the same degree.

Perhaps the nearest approach to an ideal market situation is that which exists in the grain exchanges.¹ Here we have conditions that are truly competitive. The interaction of the different grain markets largely rests upon modern methods of transportation and communication, by means of which local demand and supply are quickly balanced. It also rests upon the international demand for the commodity and to a large extent is under the direct influence of foreign prices. Conditions of the moment affect each of the respective markets, but the normal ratios of the prices in one market relative to the prices in other markets remain fairly constant, for the direction of the flow changes slowly.²

How the equilibrium is restored.—The responsibility for this high degree of equilibrium in the grain markets lies with the spreader.³ It is the spreader who brings the markets into line. The spreading operation consists in the purchase of a future option in one market where the price is low, and the sale at the same time for forward delivery in another market where the price is high, transporting the produce from one to the other, if necessary, to fulfil the contract. Instead of moving the produce, however, the trader may buy futures in the one market and sell futures in the other, thus closing out each prior contract in the market where it was first made. This operation tends to raise the price of the lower market and reduce the price in the

¹ This statement is undoubtedly open to question. Some critics would not regard the grain exchanges as ideal in any sense of the word.

² Cf. Zapoleon, *op. cit.*, p. 447.

³ The term "spreader" is used here in the broad sense. Large hedgers are responsible for the great bulk of inter-market operations in futures.

higher market, thus pulling the two markets together. If this process is continued long enough, the effect will be to restore the equilibrium in prices that normally exists between the two markets.

The analysis of price equilibrium.—The two methods most commonly used in the analysis of price equilibrium are known as the qualitative and the quantitative methods. The qualitative method is used by the classical and neo-classical economists, and the quantitative method is used by the mathematical economists. The difference between the two consists largely in the degree of accuracy which may be obtained by the different methods.

The classical theory affords a method of analyzing price equilibrium which is quite satisfactory in the general field of production and distribution. It assumes that all other variables are being held constant except the one under consideration. The effect of changes in this variable may be registered on the price equilibrium by the shifting of demand and supply schedules. By this means useful approximations may be obtained.

Price equilibrium between the different grain exchanges.—The equilibrium of prices between the different grain exchanges as investigated in the present study does not differ greatly from the types of price equilibrium as found in international trade.⁴ There are deficit area and surplus areas which require the actual movement of the commodity and the settlement of the balances of trade must be met in the ordinary manner.

The different grain exchanges, such as Kansas City and Chicago, are the gateways through which the wheat flows from the producing west to the consuming east. If all the wheat from the Kansas City territory had to pass through Chicago on its way to the east for consumption or export, the spread on comparable grades between the two markets would correspond

⁴ This is true in a limited sense only, due to tariff barriers.

quite closely to the shipping charge between Kansas City and Chicago.

Not all the wheat from the Kansas City territory passes through Chicago, however.⁵ A large percentage goes directly to the Gulf for export while another portion is milled into flour in the Kansas City territory.

During those periods when the export demand is strong enough to keep the wheat from accumulating at the Gulf, the alternate route for export by way of the Gulf is an important factor in regulating the size of the price spread between Kansas City and Chicago. If, however, the wheat accumulates at the Gulf and does not find a ready sale, the question of alternate routes for export is no longer an important factor affecting the spread. It usually happens that the surplus in the Kansas City market is disposed of within a few months after the opening of the harvest season, and the export demand for the remainder of the crop year is such that the cheaper rate over the alternate route by way of the Gulf has a tendency to narrow the spread between Kansas City and Chicago.

Economic limit to the size of the price spread.—The shipping charge affords an automatic check upon the degree to which an option in one market can go to a premium over the same option in another market. In other words, there is an economic limit to the size of the spread between markets.

This economic limit is governed by the cost necessary to buy a certain grade of wheat in a market of lower price and deliver that grade in a market of higher price for the option which is being traded in. Thus if the premium of the option in the one market amounts to a sufficient number of cents per bushel over the corresponding option in the other market, to more than cover transportation charges between the two markets,

⁵ Professor Duddy of the University of Chicago estimates that 18.95 per cent of the wheat received in Chicago by rail came from Kansas City during the seven-year period ending in June, 1931.

spreaders who are in position to take or make delivery on the futures can obtain a sure profit by buying the grain for future delivery in the one market and shipping it to the other market for delivery purposes. The effect of this operation is to restore the equilibrium in prices between the two markets. Such a transaction involves a thorough knowledge of transportation costs as well as carrying charges, interest, insurance, deliverable grades, etc.

There is also a lower limit to which the price spread may go in the opposite direction. It might be possible for the situation, as explained above, to be reversed so that market A, which in the former instance commanded a premium over market B, is now at a discount. In this case the economic limit would be reached when market A went to a sufficient discount under market B so that the shipping charges would be covered, whereupon the wheat could flow in the opposite direction. This situation is improbable except under abnormal circumstances since there is a normal flow of grain from the surplus regions to consuming areas.

Since there are economic limits to the size of the spread between different markets, the spreader has what is called a "margin of safety." The spreading transaction becomes relatively safer as the size of the spread approaches this economic limit. The spreader may not wait for the spread to reach the economic limit before entering the market since he knows that the spread in price cannot go beyond a certain point. Even if the spread does go against him he may keep on "spreading"⁶ larger and larger quantities as he gets farther and farther into the safety zone. He operates on the assumption that when the economic limit is reached the spread will not go further because of the actual movement of grain and that in the meantime he can still make profits in spite of the fact that the spread has

⁶ This is the language used on the Board of Trade and implies that additional spreading transactions will be made.

gone against him, since there are numerous fluctuations which may be to his advantage.

It will readily be discovered from what has been said that the economic limit to the size of the spread corresponds to the shipping charge, and that a safety zone with undefined boundaries exists in the vicinity of this economic limit. The lower economic limit to the size of the spread will therefore correspond to the cost of shipping the wheat in the opposite direction.

The spreader does not wait for the spread to approach the lower economic limit before entering the market. He takes account of the ordinary demand and supply factors including the normal flow of grain for export from one market through the other, and determines his actions accordingly. When the spread narrows⁷ until he thinks it cannot go further, he may enter the market by buying the option in market A and selling the option in market B. The spread may now go against him by narrowing still further or it may go in his favor by widening sufficiently to show a nice profit so that he can close out his trades in both markets simultaneously and wait for another favorable opportunity.

⁷ This situation is known as the "backspread." In a later section of the study, the backspread is defined as the relative position of the two markets when the difference in price is less than the normal one.

CHAPTER III

RELATIONSHIP OF THE SPREAD TO SHIPPING COST

There are two significant relationships between freight rates and price spreads between Kansas City and Chicago which may be stated as follows:

1. The spread is related to the direct cost of shipping wheat from Kansas City to Chicago. The "direct cost" affects the spread in that it affords an "economic limit to the size of the spread" by allowing the wheat to be transported from Kansas City to Chicago when the spread in wheat prices widens to the point where the actual grain may be shipped at a profit between the two markets.

2. The spread is related to the comparative cost of shipping wheat for export over "alternate routes," one of which is by way of Chicago and the Atlantic seaboard and the other by way of the Gulf of Mexico.¹ The question of alternate routes affects the Kansas City-Chicago spread by allowing export grain to be shipped over routes other than the Chicago route. The movement by other routes may be such that export wheat will move out of the country via the Gulf, the result of which is to make the price in Kansas City relatively higher than if the price in Kansas City were determined by the direct cost of shipping between Kansas City and Chicago. The effect of such movements will be to cause the spreads between Kansas City and Chicago to narrow to less than the shipping cost between the two markets.

The rate situation between Kansas City and Chicago.—Many fluctuations occurred in the rates on grain between Kansas

¹ The spreads between Kansas City and Chicago are also affected to a minor degree by a movement of grain from Kansas City to St. Louis and eastward to the Atlantic seaboard.

City and Chicago between the years 1901 and 1905. The following statement from the Interstate Commerce Commission is representative of the situation.²

The distance from Kansas City to Chicago by the short line is approximately 450 miles. Grain has frequently been carried between these cities for six cents per hundred pounds; the published rate during the summer of 1902 was seven cents per hundred pounds for a time, the average was about eleven cents per hundred.

Previous to 1905 there were many diversions from the published tariffs. "Competition at Kansas City has always been extremely active and the open rate has seldom been observed."³ There is no means of knowing the extent of the concessions which occurred during the early part of the period from 1901 to 1929, but the variations were evidently of considerable importance.

After 1905 there were not so many fluctuations in the published tariffs and the concessions in the form of rate cuts granted by the railroads to the shippers had gradually diminished.

As the concessions to the shippers began to diminish other forms of special privileges began to increase. One of the most important of these was that which had to do with "transit balances."

During the latter part of the period 1905-29, the use of transit balances became very common. These transit balances were lower than the proportional rates. An interesting example is described by the Interstate Commerce Commission⁴ as follows:

The rate on through shipments of wheat from Kansas City to Chicago is the flat rate to Kansas City, plus the proportional rate of 17.5 cents beyond, but Kansas wheat stopped at Kansas City for merchandising, milling or other purposes, may move out of Kansas City to Chicago at

² *Interstate Commerce Commission Reports*, IX, 547.

³ *Ibid.*, p. 546.

⁴ *Ibid.*, CLXIV, 638.

9.5 cents upon surrender of an expense bill showing the inbound shipment of an equivalent amount of wheat from Omaha to Kansas City. . . . A substantial, if not the greater part of the outbound tonnage from the Missouri River to both Chicago and St. Louis pays transit balances less than the proportionals.⁵

The following statement from the same reference is also significant:

Kansas City is apprehensive that the discrimination in favor of the outbound shippers under transit balances, and against the outbound shippers of grain delivered under future contracts, at the higher proportional rates, may eventually reach the point of preventing deliveries on futures contracts, and drive the professional trader and the hedger out of the Kansas City market, and thereby eliminate Kansas City as a futures market. It is said that Kansas City's price would then be merely the Chicago price minus the freight rate from Kansas City to Chicago, whereas today, by reason of the location of Kansas City closer than Chicago to much of the grain producing territory, and by reason also of the greater demand for grain at Kansas City than at Chicago from the Southwest and certain other localities, the futures price at Kansas City is higher than the Chicago price minus the freight rate from Kansas City to Chicago, and is therefore relatively higher than the price at Chicago.⁶

Comparison of the May spread with the proportional rates between Kansas City and Chicago.—Table III shows the May spread, 1901–29, and the different revisions of the proportional rates between Kansas City and Chicago from 1905 to 1929. The rates shown in this table are the published proportional rates and do not take account of the concessions from the railroads to the shippers.

Movement of wheat from Kansas City to Chicago.—Inspection of Table III would lead one to believe that wheat could not actually move from Kansas City to Chicago because of the an-

⁵ The proportional rate to Chicago (before July 1, 1930) was 17.5 cents from both Omaha and Kansas City. The proportional rate from Omaha to Kansas City is 8 cents. The 9.5 cents is the transit balance beyond Kansas City of the proportional rate of 17.5 cents from Omaha to Chicago applied with transit at Kansas City. *Interstate Commerce Commission Reports*, CLXIV, 638.

⁶ *Interstate Commerce Commission Reports*, CLXIV, 642.

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nual averages of the spreads being less than the shipping cost. This is not true, however. In the past there has been a con-

TABLE III
COMPARISON OF THE PROPORTIONAL RATES AND MAY SPREAD
BETWEEN KANSAS CITY AND CHICAGO SHOWING ANNUAL
AVERAGE FOR CROP-YEARS, 1901-29

CROP-YEARS	PROPORTIONAL RATES*	MAY SPREAD
	Cents per Bushel	Cents per Bushel
1901-02.....	6.60*	2.880
1902-03.....	6.60*	8.972
1903-04.....	6.60*	12.122
1904-05.....	6.90*	11.176
1905-06.....	6.45*	6.908
1906-07.....	7.20	6.386
1907-08.....	7.20	4.518
1908-09.....	7.20	6.438
1909-10.....	7.20	5.205
1910-11.....	7.20	4.001
1911-12.....	7.20	1.851
1912-13.....	7.20	5.460
1913-14.....	7.20	5.229
1914-15.....	7.20	7.304
1915-16.....	7.20	6.935
1916-17.....	7.20	1.245
1917-18.....	.....	.....
1918-19.....	.....	.....
1920-21.....	12.30*	6.790
1921-22.....	10.75*	9.766
1922-23.....	10.50	7.770
1923-24.....	10.50	5.286
1924-25.....	10.50	8.492
1925-26.....	10.50	4.419
1926-27.....	10.50	6.729
1927-28.....	10.50	6.232
1928-29.....	10.50	6.887

* Approximate.

Interstate Commerce Commission Tariff Investigation, No. 17,000, Part VII, p. 7. C. M. & St. P. Interstate Commerce Commission Tariff, A-888, B-257, A-9945, B-4165, and B-4612. A. T. & S. F. I.C.C. Tariff 2980.

tinual movement of wheat from Kansas City to Chicago during every month of the year. At times this movement is much more pronounced than at other times.

There are occasions when the spread widens to the point where large quantities of cash wheat are shipped from Kansas City to Chicago on the basis of proportional rates.⁷ This condition existed during the year 1921, at which time the spread in May wheat widened to as much as fourteen cents for quite a long period of time.

It should be kept in mind that the freight rates shown in Table III are the published proportional rates and that actual rates during the period have been somewhat less due to concessions to shippers in the form of rate cuts, transit balances, favorable billing from points of origin, etc. It should also be kept in mind that the average spreads are based on futures prices with deliveries to be made in May and that these futures prices may have quite a wide degree of variation from the cash prices at all times, except during the month of delivery.

The cash spreads in wheat may be such that grain may actually move from one market to the other, even though the futures spreads do not correspond to the cash spreads and apparently there can be no movement of grain.⁸

The real test of the movement of grain may be obtained from the records of the railroad companies showing the shipments of grain during the period. This record is available for the later part of the period previous to 1929.⁹

EFFECT OF ALTERNATE ROUTES FOR EXPORT ON THE SIZE OF THE SPREADS

The theory is quite prevalent among grain men that one of the chief reasons why the spread between Kansas City and Chicago is less than the direct shipping cost is because wheat may be shipped from Kansas City for export at a lower rate by

⁷ See Tables III and V.

⁸ The relationship of the future spreads to cash spreads is discussed under the subject of deliverable grades.

⁹ See Table V in chap. iv.

way of the Gulf than by way of Chicago.¹⁰ Their reason for thinking this to be true is because ocean transportation is cheaper than rail transportation and the southern route involves a greater degree of ocean transportation than the northern route.

If Kansas City had a geographical location which required that all the surplus wheat, shipped from Kansas City for export, had to pass through Chicago, there would no doubt be a very close resemblance between the cost of transportation and the spread in cash between the two markets.¹¹

The factor of freight rates is usually regarded as a constant factor which affects the spread uniformly as long as there are no changes in rates. There have been few changes in the "rail" rates of the alternate routes as described above, but since both of the routes involve "ocean" transportation there is considerable variation in the transportation costs of the two routes due to the changes in the costs of ocean transportation.

In the present study an effort has been made to compare the cost of shipping wheat from Kansas City for export over the alternate routes. A history of the rail rates for both of the routes from 1905 to 1929 with the differences of the Gulf over the Chicago rate is shown in Table IV.

Comparison of export rates from Kansas City by way of the different export routes.—It would be very difficult to determine the annual averages of the combined rail and ocean rates over the alternate routes for a period of years. If such annual averages could be obtained they would be very desirable for the

¹⁰ The effect of the lower rate by way of the Gulf is to narrow the spreads between Kansas City and Chicago.

¹¹ Kansas City is not to be classed entirely as an export market. The milling industry takes a large amount of wheat from the Kansas City territory and a very large portion of it is also shipped to the milling sections in the spring-wheat territory centering at Minneapolis. Since this is true, the spreads between Kansas City and Chicago are not determined entirely on the basis of export rates but also upon the demand and supply factors of the domestic market.

purpose of comparison with the annual averages of the spreads to see if the variation in the differences of the alternate routes could correspond to the variations in the spreads.

TABLE IV

COMPARISON OF PROPORTIONAL RATES OF WHEAT FOR EXPORT
FROM KANSAS CITY TO GULF PORTS WITH PROPOR-
TIONAL RATES TO CHICAGO*

DATE	CENTS PER HUNDRED POUNDS		
	Gulf Rate	Rate to Chicago	Difference in Gulf Rate over Chicago
October 1, 1905.....	15.25	11.00	4.25
January 1, 1906.....	18.00	12.00	6.00
July 8, 1906.....	16.75	12.00	4.75
July 17, 1906.....	16.75	10.75	6.00
July 30, 1906.....	15.25	8.00	7.25
August 11, 1906.....	18.00	10.75	7.25
September 1, 1906.....	16.25	10.75	5.50
October 15, 1906.....	17.25	10.75	6.50
April 1, 1907.....	18.50	10.75	7.75
April 9, 1907.....	17.25	10.75	6.50
July 1, 1907.....	18.50	12.00	6.50
August 12, 1912.....	14.50	12.00	2.50
December 23, 1912.....	18.50	12.00	6.50
February 10, 1915.....	19.20	12.00	7.20
March 12, 1917.....	20.00	12.00	8.00
June 25, 1918.....	25.00	15.00	10.00
December 30, 1919.....	28.00	15.00	13.00
August 26, 1920.....	38.00	20.50	17.50
September 12, 1921.....	32.50	20.50	12.00
January 1, 1922.....	30.50	17.50	13.00

* *Interstate Commerce Commission Tariff Investigation, No. 17,000, Part VII, p. 7.* C. M. & St. P. Interstate Commerce Commission Tariff, A-888, B-257, A-9945, B-4165, and B-4612. A.T. & S. F. I. C. C. Tariff 2980.

No attempt will be made to determine what these annual variations via the alternate routes have been. Three illustrations will be given, however, showing the differences in the rates of the alternate routes for the years 1923, 1925, and 1927. These are as follows:

22 PRICE DIFFERENTIALS IN WHEAT FUTURES

*Differences in the rates of the alternate routes from Kansas City to Liverpool for the year 1923:*¹²

A. Via Chicago and New York:

From Kansas City to New York.....	24.3 cents per bushel
From New York to Liverpool.....	<u>8.0</u>
Total.....	32.3

B. Via the Gulf:

From Kansas City to the Gulf (rail).....	18.3
From Gulf to Liverpool.....	<u>11.0</u>
Total.....	29.3

Difference in the alternate routes, 3 cents per bushel.

*Differences in the rates of the alternate routes from Kansas City to Liverpool for the year 1925:*¹³

A. Via Chicago and New York.....40.1 cents per bushel

B. Via Gulf of Mexico.....37.5

Difference in the alternate routes, 2.6 cents per bushel. The above is the average for the year 1925.

*Differences in the rates of the alternate routes from Kansas City to Liverpool for the year 1927:*¹⁴

Cost from Kansas City to Liverpool via Chicago:

Kansas City to Chicago by rail.....	10.50
Elevating charge at Chicago (lake).....	1.25
Lake rate to Buffalo from Chicago.....	3.00
Insurance on lake.....	0.50
F.O.B. from Buffalo to steamer at New York.	11.00
Ocean rate to Liverpool ¹⁵	7.50
Insurance on ocean ¹⁶	<u>0.75</u>
Total.....	34.50

¹² Alfred H. Ritter, "Influence of Transportation Costs on The Wheat Trade of the United States," *World Wheat Markets*, 1925, p. 11.

¹³ *I.C.C. No. 17,000*, Part VII. Rate structure investigation probably made by Clyde Reed who later became governor of Kansas.

¹⁴ This investigation was made in connection with the present study in November, 1927. The best information that could be gained at the time was obtained from Mr. Kasdors, a representative of the Rosenbaum Grain Company. Mr. Kasdors handled the export trade of the Rosenbaum Company, which is one of the largest exporters of grain in the Chicago district. The date for the rates as shown above was November 17, 1927.

¹⁵ These rates were quoted by Mr. Kasdors from his current quotations. The other charges have been verified from other sources.

¹⁶ *Ibid.*

Cost from Kansas City to Liverpool via Galveston:

Kansas City to Galveston by rail.....	18.9
Insurance on ocean.....	1.0
F.O.B. and other charges.....	3.25
Ocean rate to Liverpool ¹⁷	9.75
Total.....	32.90

Difference in favor of the Galveston rate, 1.6 cents per bushel.

Summary of the above results.—The differences in favor of the Gulf route as compared with the route by way of Chicago for the three investigations are as follows:¹⁸

Cents per Bushel	
For the year 1923.....	3.0
For the year 1925.....	2.6
For the year 1927.....	1.6

Effect of lower rates via the Gulf is to narrow the spread.—During the past there has been a continual movement of wheat from Kansas City for export via the Gulf. Absolute proof is not at hand but all the investigations seem to indicate that export rates from Kansas City are lower by way of the Gulf than by way of Chicago. This is indicated not only from the inquiries and investigations that have been made as to rates but also from the fact that the export wheat actually moves toward the Gulf when intended solely for export.

The effect of these lower rates by way of the Gulf is to narrow the spreads between Kansas City and Chicago, since exporters shipping by way of Chicago cannot compete with those who ship over the southern route. This has a tendency to make the price in Kansas City relatively higher than that in Chicago.

¹⁷ *Ibid.*

¹⁸ The trend line of the Kansas City-Chicago May spread for the post-war period (1921-29) has a slightly negative tendency. This would seem to indicate that the lowering of the rate by way of the Gulf has a tendency to narrow the spread between Kansas City and Chicago. The equation for the Kansas City-Chicago May spread is $y = 6.93 - 0.219x$, with the y unit in cents per bushel and the x unit in years. The origin is at the beginning of 1925. The period of years is from 1921-29.

There is an apparent discrepancy between spreads and shipping cost in which it appears that wheat moves from Kansas City to Chicago during times when the spreads are less than the shipping cost.

A large part of this apparent discrepancy is due to the fact that wheat moves on transit balances at rates lower than the proportional rates. The average proportional rate for the post-war period, as shown in Table III, is about $10\frac{1}{2}$ cents per bushel. The rate due to transit balances during this period, however, has been very much less.¹⁹ Interviews with practical grain men would seem to indicate that wheat often moves from Kansas City to Chicago as low as seven cents per bushel, while the average during the post-war period should be somewhere between 8 and 10 cents per bushel. The proportional rate is such that Kansas City wheat intended for export cannot go by way of Chicago but large quantities of wheat are moved from Kansas City to Chicago by speculators, terminal elevator companies, etc., and later moved on for export. At times during the months of July, August, and September, the heavy market commitments of cash wheat at Kansas City cause a congested condition in which the overflow wheat moves either toward Chicago or toward the Gulf. When this congested condition is in evidence, the spread on cash wheat widens out to the full shipping charge. Thus the size of the July spread corresponds quite closely to the freight rate,²⁰ although there is some variation from year to year due to other causes. In the same way the September spread is influenced to a lesser degree by the shipping charge.

The apparent discrepancy, in which it appears that wheat

¹⁹ Mr. Stewart of the Rosenbaum Grain Company estimates that the average rate on all wheat transported from Kansas City to Chicago during the post-war period has been about 9 cents. Actual records are extremely difficult to obtain.

²⁰ This is due to the fact that the deliveries in the July option come during the month of July when the market commitments are the heaviest. This will be discussed in chap. iv.

moves from Kansas City to Chicago during times when the average spreads are less than the shipping cost, may not be accounted for entirely on the basis of transit balances. Part is due to the fact that the spreads are based on futures prices which may differ from cash prices.²¹ A part may also be accounted for on the basis of deliverable grades. Country-run grain is sometimes more desirable than contract grades and may be moved for mixing purposes or for milling when the spreads would not seem to justify the movement. The factor of time is also important in accounting for the apparent discrepancy, since wheat may be purchased previous to the time of shipment. Savings in storage and insurance may also be a reason for moving wheat to other points under seemingly adverse circumstances.²² In addition to the above factors it is perhaps true that not all those who are engaged in handling wheat are successful in making profits.

²¹ For short periods the actual spread may differ considerably from the averages.

²² Some wheat is brought to Chicago by the terminal elevator people to take advantage of their storage.

CHAPTER IV

EFFECT OF DEMAND AND SUPPLY UPON THE SPREADS

The shipping cost from Kansas City to Chicago and the relative value of wheat that will be delivered on the various contracts in each of the markets are the fixed or constant factors in the maintenance of price spreads, while the chief variables are the "size" and "quality" of the crops in the sections tributary to the respective markets, together with the probable extent and source of the consumptive demand.¹ A short crop of hard winter wheat in the southwest will find such a strong milling demand that the spread in futures between the two markets will narrow, while if the crop is heavy the opposite effect will be true. A short crop in the southwest will have greater effect upon Kansas City than upon Chicago because of the localized milling interest in Kansas City.

The above statement will be broken up for the purpose of analysis and an attempt will be made to discover which factors

¹ It is quite generally recognized among active grain men that the spreads between Kansas City and Chicago narrow with the strengthening of the milling and the export demand. For example, the following items were taken at random from the market news column of the *Chicago Tribune* of December 5, 1931:

"The cash wheat situation continues to grow stronger, and the spread between Chicago and northwestern and southwestern markets has narrowed sharply within a week."

"Movement of wheat to terminals remains unusually small and mills are being forced to draw on points of accumulation for supplies, being unable to secure sufficient grain from the interior."

"Mills continue in the market for supplies of cash wheat, especially red winter, and it was understood that mills in the southeastern states are badly in need of soft winter grain and were having difficulty in securing it. The basis in the local sample market was one-half cent higher as compared with the December, and practically all grades of contract wheat in the northwest and southwestern markets are selling at premiums over the futures."

are important in determining the price variations in the spreads between Kansas City and Chicago.

The investigation will be based largely upon "quantity" relationships dealing with the size of crops, etc., rather than "value" relationships dealing with the value of the crops.²

The chief concern will be to investigate the local forces of demand and supply that affect the Kansas City market without affecting the Chicago market or that affect both markets to different degrees.³

The different grain exchanges such as Kansas City and Chicago are the gateways through which the wheat flows from the producing west to the consuming east and it is the local forces⁴ of demand and supply which affect the price of wheat in one of those markets without affecting the price in the other markets to the same degree.

It is expected that for short periods the prices in individual markets may be temporarily "out of line" with other markets but this situation is expected to be corrected by the "spreading" operations of traders. During seasons of small production an individual locality may have little surplus wheat and consequently prices there may be above the ordinary shipping basis.

Traders who are interested in the price of wheat are often more concerned over the factors which affect the forces of supply rather than those of demand. This is because wheat is used almost wholly for human food, has a very low elasticity of demand, and shows a comparatively narrow margin of change

² Attempts have been made by the Federal Trade Commission, VI, 108 ff., to determine the relationship between the price of wheat and the size of the spreads between the different markets. Those attempts were based upon value relationships and were unsuccessful and hence will be avoided in the present study.

³ Other sections of the study have shown that freight rates and deliverable grades have remained fairly constant during the period studied and hence may be disregarded in the following section on demand and supply.

⁴ This is true in a limited sense only.

in per capita consumption in response to a given change in price. Traders know that a certain quantity of wheat is likely to be used each year and the question is whether the supply will be more than sufficient to fulfil the needs. This is somewhat offset by the fact that a surplus from one crop is easily made available in the next crop year by carrying over some of the supply.

ANALYSIS OF THE MAY SPREAD

The procedure followed in the statistical analysis, except when stated otherwise, was to fit trends to the series under investigation and to compute the ratio of the actual values to the respective trend values. These ratios were then correlated. By using trend ratios instead of actual data we eliminate, to a first approximation, the effect of the long-time disturbing elements on the factors under discussion. The study covers the years 1903-29, omitting the years 1915-21.

The relation of the quantity of the crop to the May spread.—The first problem that presented itself was to find out whether a significant relationship existed between the total wheat crop in the United States and the spread in May wheat between Chicago and Kansas City. In years of large crops in the United States the surplus wheat is presumably not so readily absorbed either by the exporters or by the mills. This surplus wheat accumulates in Kansas City or the surrounding territory, and moves only when the spreads widen to the point where the shipping charges of moving the wheat from the surplus producing regions to the east for export or consumption are covered. When the total wheat crop is small, the demand of the exporters and of the mills will readily absorb the surplus, and cause the price spread between Kansas City and Chicago to narrow to less than the shipping charge between the two markets, especially so if there is a surplus of soft red winter or of hard red spring wheat. The extent of this narrowing of the

spread depends upon the demand at Kansas City for the available supplies in that territory. If the relationship between the total wheat crop in the United States and the spread of May wheat between Kansas City and Chicago were perfect, we would obtain a correlation coefficient of unity. A value of zero, on the other hand, would indicate absolute lack of dependence. The value obtained for the variables in question was -0.125 , indicating that the relationship between the total wheat crop and the May spread is insignificant.

Since the hard winter wheat in the Kansas City territory is very much in demand to be mixed with the spring wheat in the northern sections when the spring wheat crop is short, the ratio between the two should show some relationship to the spread, that is, a large winter-wheat crop relative to the size of the spring-wheat crop would result in a wide spread; the reverse condition should bring about a narrow spread. The value of the correlation coefficient does not, however, support this argument; the value obtained was 0.134 .

A more significant relationship was found to exist between the May spread and the ratio of the crop in the three hard winter states to the crop in the four northern spring states. The hard winter wheat in the Kansas City territory is very much in demand to be mixed with the northern spring wheat in the Minneapolis territory, and a change in the ratio of the crop in the one section relative to the other section should be accompanied by a corresponding change in the size of the spread between Kansas City and Chicago, the price at Chicago being affected by the price at Minneapolis. The ratios of the three "hard winter states" to the four "spring wheat states" were obtained by dividing the combined total production of the three hard winter states for each year by the combined total production of the four spring wheat states for the same year. The coefficient of correlation obtained between these ratios and the May spread was 0.476 , with a standard error of ± 0.173 .

Still better results were obtained when the May spread was correlated with the wheat crop in Kansas, Oklahoma, and Nebraska. These three states produce the major portion of hard winter wheat in the surplus producing sections around Kansas City, and the quantity of wheat produced there will be the chief factor in determining the size of the spread between Kansas City and Chicago. The effect of large crops in these states will be to depress the price of wheat at Kansas City relative to Chicago and vice versa. The coefficient of correlation of 0.66 with a standard error of ± 0.127 , was obtained for the May spread and the "production of the three states." Almost the same value was obtained when the May spread was correlated with the production of wheat in Kansas alone, r being 0.65 with a standard error of ± 0.13 .

Another step in the analysis of the factors which influence the price variations between Kansas City and Chicago was to substitute "total receipts of wheat at Kansas City" for production data. The coefficient of correlation was found to be 0.834, with a standard error of ± 0.07 , which indicates a high degree of relationship.⁵

The data were examined still more thoroughly. Several changes in freight rates had occurred during the period and the question was raised as to whether these changes in freight rates might affect the correlation. If the effect of the changes in freight rates could be removed from the spread, a more satisfactory examination could be made of the influence on the spread which is due to receipts at Kansas City only. During the earlier part of the pre-war period minor changes had occurred in the freight rates between Kansas City and Chicago, and a net increase of 3.3 cents per bushel occurred during the

⁵ As mentioned before, the analysis has been in terms of ratios to trends. When the factor "time" was introduced as a separate variable in the analysis of receipts at Kansas City and May spread, the coefficient of multiple correlation was found to be $R=0.720$, with a standard error of ± 0.107 . When deviations from linear trends were correlated, a value of ± 0.711 was obtained.

war which remained in effect during the post-war period. The May spread was now adjusted for the effect of freight rates by subtracting 3.3 cents per bushel for each of the post-war years and by making similar corrections for those years in which changes occurred during the pre-war period. The period was changed to 1906-29, instead of 1903-29. The years 1915-16, which had been omitted in the previous computations, were now included, making nineteen years in all. The inclusion of these two years, which are somewhat abnormal, lowered the coefficient of correlation, but the net result was still very satisfactory. The coefficient of correlation between the "May spread" and the corrected "receipts of wheat at Kansas City" was found to be 0.773 with a standard error ± 0.097 . While this coefficient is not as high as it would have been if the data were not corrected for the changes in freight rates, it is considered very satisfactory, since it shows that a significant relationship between the two variables exists, even when the influence of freight rates is eliminated.⁶

As a further test, the coefficient of correlation was computed between the "May spread" and "receipts of wheat at Kansas City" for the post-war period extending from 1922 to 1929. The relationship is almost perfect, the coefficient of correlation being 0.922 with a standard error of ± 0.05 .

The relationship of the quality of the crop to the May spread.—The commonly accepted theory among the grain traders is that not only the size of the crop in the different sections is an important factor in determining the inter-market spread,

⁶ The equation for the "receipts of wheat at Kansas City" after the inclusion of the two additional years was $y = 61.465 + 2.725x$, with the origin at the mid point of the year 1917. The y unit is in millions of bushels and the x unit is in years.

The equation for the May spread after the two additional years were included, and after adjusting for the effect of the change in freight rates, is $y = 4.566 - 0.121x$, with the origin at the mid point of the year 1917. The y unit is in cents per bushel and the x unit is in years.

but also the quality of the crop. If the crop in the Minneapolis territory is of poor quality, wheat from the Kansas City district will be in great demand by millers. Bakers require flour of specified protein content, and the poor quality spring wheat of the northwest cannot be made into flour that will meet the requirements unless it is mixed with the hard winter wheat. On the other hand, if the wheat in the Kansas City district is of poor quality and contains a low percentage of protein it will not be so much in demand by the mills and hence will not command as high a price relative to other markets. It is, of course, much more difficult to arrive at a standard for the quality of the crop than it is to determine the size of the crop, because there are no recognized standards for determining the protein content. Only during recent years have the millers begun to consider the protein factor as very important because the bakers have been demanding flour of specified protein content. For this reason, the millers are willing to pay premiums on high-protein wheat. This practice has, however, not yet become standardized to the degree that certain specifications are required on contract grades. The best available index of "quality" of wheat raised in the Kansas City territory is the report of carload receipts by grades by the licensed inspectors in Kansas City. An official record is kept of the number of carloads of hard winter wheat received each year grading from number one to number five, as well as of the carloads of off-grades which are sold according to sample. The reports of these licensed inspectors were obtained from the Kansas City Board of Trade, and ratios showing the percentage of carloads of hard red winter wheat that graded number one and number two to the total carload receipts inspected during the year at Kansas City were computed. In this manner data were obtained for each year showing the percentage of cars of high-grade wheat received in Kansas City. The data received from the Board of Trade began with 1917 and extended to 1929, but since there

was no trading in futures during the war, the statistical analysis had to be limited to the post-war period, 1921-29. The coefficient of correlation was found to be 0.282, which would indicate that the relationship between the quality of the crop *as measured by the percentage of wheat grading number one and number two*, and the May spread is insignificant. The period studied is, however, too short to draw definite conclusions from the results.

The next step in the analysis was to compute the ratios of the percentages which high-grade wheat formed of total receipts at Kansas City to the percentages which high-grade wheat formed of total receipts at Chicago. These ratios are significant because only one basic variety, consisting of hard winter wheat, is deliverable at Chicago. Should the crop of hard winter wheat in the vicinity of Kansas City be of good quality while the crop in the Chicago territory is of poor quality, there will be a strong demand for the Kansas City wheat relative to the demand for the Chicago wheat, and the spread will narrow to a small margin between the two markets. If, on the other hand, the wheat in the Kansas City district should be of poor quality, while that in the Chicago territory is of good quality, the opposite effect will be true and there will not be the corresponding demand for the Kansas City wheat relative to that of the Chicago wheat. Under those conditions the spread will widen to the point where "local" demand and supply factors are unimportant, and the export demand, together with the constant factor of freight rates, will be the chief factors in determining the spread between the two markets. The correlation between the May spread and these ratios was, however, low, the coefficient of correlation having a value of 0.355.

The relationship of exports to the May spread.—Another factor which might influence the spread in prices between Kansas City and Chicago is the quantity exported. Since most of the hard winter wheat exported comes from the Kansas City dis-

trict, a large crop of hard winter wheat in that territory causes a large overflow which goes for export by way of the Gulf of Mexico. During those years in which the exports are large, there should be a widening of the spread, while the spread should narrow during those years in which the exports are small. Several attempts have been made to determine whether the high coefficient of correlation, which was found to exist between exports and spreads, might be an indication of "export demand" or whether it is simply a reflection of a large crop in the Kansas City territory. The assumption is made that the supply factors cause the spread to widen while the demand factors cause it to narrow. Thus, if the exports via the Gulf are a demand factor, they will cause a narrowing of the spread, and the years in which the exports are largest should also be years in which the spreads are smallest. This is, however, not the case. In the years when the exports are very large, the spreads are the widest. This fact would indicate that the exports via the Gulf are a supply factor rather than a demand factor. Large exports are simply the result of the overflow from Kansas City rather than the indication of export demand. Sometime during the year the slack is taken up in the Kansas City market and the demand from exporters has a tendency to narrow the spread. This fact is discussed more fully in connection with the December spread. As mentioned before, the correlation between exports of hard winter wheat and May spread is relatively high. The coefficient of correlation was found to be 0.839 with a standard error of ± 0.118 referring to the period 1922-29.

Information covering a longer period was available for all wheat exported from the customs districts along the Gulf of Mexico. For the sake of homogeneity the series were broken up into a pre-war and a post-war period. The coefficient of correlation for the pre-war period (1903-14) is 0.582 with a standard error of ± 0.191 . The post-war period, in which the variations in exports from year to year have been much smaller,

shows an almost perfect relationship between exports from the Gulf and May spread, the coefficient of correlation being 0.948 with a standard error of only ± 0.04 . This correlation was still improved when the combined effect of exports via the Gulf and receipts at Kansas City upon the May spread was measured. The coefficient of multiple correlation was 0.991 with a standard error of ± 0.006 .

THE JULY SPREAD

It has previously been explained that the tendency for all the spreads is to widen during the winter and spring seasons until the peak is reached in June and July. It is very logical for this to be the case since the accumulation of wheat in Kansas City during the July threshing season⁷ causes the price in Kansas City to be depressed at that time relative to Chicago, so that when the deliveries of the July option are being made the spread is at the widest point of the year. The overflow wheat flows from Kansas City to Chicago at the lowest obtainable shipping charge and the tendency is for the spread to conform to this charge.

This tendency of the July spread to conform to the freight rate causes a much higher degree of uniformity in the July spread than in the spreads of the other options. This may readily be seen upon inspection of Table I and the accompanying chart in chapter i (Fig. 1). This uniformity from year to year is much more pronounced during the post-war period than during the pre-war period. An explanation of this may possibly be found in the effect which the "combine harvester thresher" has had on the situation by causing the wheat to be marketed earlier in the season⁸ during the post-war period than during the pre-war period. Since the uniformity from year to

⁷ Theodore D. Hammatt, *Seasonal Aspects of Wheat Exporting*, Bulletin 350, United States Department of Commerce, 1925, pp. 2 ff.

⁸ The earlier marketing of wheat during the post-war period may be verified from the annual reports of the Kansas City Board of Trade by inspection of the monthly receipts during the pre-war and post-war periods.

year in the July spread may be interpreted largely upon the basis of freight rates, no attempt has been made to correlate it with other series of data.

THE SEPTEMBER SPREAD

Inspection of Table I and Figure 1 in chapter 1 shows wider ranges of fluctuation from year to year for the September spread than for the July spread. This is because the September deliveries are made under conditions that are quite different from those of the July deliveries.

By the time the September deliveries are made, the congested condition at Kansas City is largely relieved and the congestion has been transferred from Kansas City to Chicago, due to the fact that the overflow wheat from Minneapolis has started moving toward Chicago in the meantime, an important factor in the deliveries on the September contracts. During the month of September this overflow wheat from Minneapolis has a tendency to lower the price at Chicago relative to Kansas City. Thus the spreads are much narrower during the month of September than during the month of July.

There is a very noticeable change in the year-to-year variations of the pre-war period and the post-war period of the September spread. The year-to-year variations of the pre-war period are more uniform than those of the post-war period. This is evidently due to the fact that the primary movement of wheat came somewhat later in the season during the pre-war period than during the post-war period, after the introduction of the combine. This later seasonal movement of the pre-war period extended the period of congestion into the month of September, at which time the deliveries were made. During the post-war period this uniformity is almost completely transferred from the September spread to the July spread, and the year-to-year variations in the September spread vary somewhat in the same degree as those of the May and December spreads.

Since a previous investigation has shown a rather significant relationship between the "May" spread and the "receipts" of wheat at Kansas City, the investigation was extended so as to discover the relationship between the "September" spread and the "receipts" of wheat at Kansas City. The analysis was made upon a seasonal basis rather than an annual basis. Averages of the three-month periods (July, August, and September) were obtained from year to year for the September spread. The averages of these periods from year to year were then correlated with the corresponding periods for the receipts of wheat at Kansas City. These three months were selected because a large percentage of the hard winter wheat is marketed during July, August, and September. The study covers the period from 1910 to 1929, omitting 1917-20. A coefficient of correlation of 0.689 with a standard error of ± 0.145 was obtained for September spread and receipts of wheat at Kansas City.

Receipts at Kansas City were replaced by data showing the movement of wheat from Kansas City to Chicago. It was thought that a wide price spread between Kansas City and Chicago would result in the movement of wheat. Data showing the movement of wheat from Kansas City to Chicago are available for seven years commencing with 1924. The average number of carloads of wheat shipped from Kansas City to Chicago during the months of July, August, and September of each year was correlated with the average for the corresponding three months of the September spread. A value of 0.508 with a standard error of ± 0.332 was obtained for the coefficient of correlation.

THE DECEMBER SPREAD

The nature of the December spread is such that it can be analyzed on a seasonal as well as on an annual basis. The deliveries in the December option come at a time when the heavy movement from the farms and from the primary markets has subsided. By December there is little interference in the move-

ment of wheat due to congestion or railway embargoes, and it is to be expected that the variations in the December spread are wider than those of the July or September spread. On the other hand, the trading in the December option begins during the months of heavy movement of wheat from the farms to the primary markets, and congested markets or railway embargoes may also be a factor which determines the size of the variations in the spread. During these months of early trading in the option it is difficult to estimate or to forecast what the conditions will be when the deliveries are to be made in December. Hence, trading during the early months is affected by seasonal conditions.

The relationship between the December spread and receipts of wheat at Kansas City was found to be very significant. The coefficient of correlation between the averages of July, August, and September of the variables just mentioned was 0.766, with a standard error of ± 0.096 . Heavy receipts at Kansas City during the months July, August, and September are reflected in a widening of the December spread for the corresponding months of the same year. Light receipts at Kansas City, on the other hand, are accompanied by a narrowing of the December spread.

The final step in the analysis was to correlate exports from the Gulf with the December spread. There are two routes over which the wheat from the Kansas City district may pass on its way for export. If there is a strong export demand and wheat does not accumulate at the Gulf, a large percentage of the hard winter wheat in the Kansas City district will not pass through Kansas City but will be billed from points of origin west of Kansas City direct to the Gulf. The freight rate on wheat for export is somewhat less when the wheat is billed direct to the Gulf from points of origin as compared to the rate when the wheat passes through Kansas City and thence to the Gulf or to Chicago. For this reason a strong export demand

will cause a narrowing of the spread, partly because of the saving in freight rates on wheat for export, and also because the wheat when going for export from points of origin does not accumulate at Kansas City, and thus produces the effect of an overstocked market.

Large exports may mean, however, that the larger quantities going for export are not due to an increased export demand, but are simply a reflection of a larger crop, part of which must be dumped on a foreign market.⁹

By conducting the investigation upon a seasonal basis it was felt that a method could be arrived at for determining which of the two factors mentioned above was instrumental in determining the variations in the size of the December spread. If the heavy exports were simply a reflection of a large crop in the Kansas City territory, the coefficient of correlation between the December spread and the exports from the Gulf would be positive, and there would be a direct relationship between heavy exports and a widening of the spread. On the other hand, if heavy exports were caused by a strong export demand, the result would be a narrowing of the spread, and the coefficient of correlation between the December spread and exports would be negative, indicating an inverse relationship between the size of the exports and the size of the spread.

Monthly data were available for only six years, but it was felt that this would be sufficient for a test, since previous computations had already been made on an annual basis between the May spread and exports of wheat from the Gulf.

The coefficient of correlation between the December spread (average of July, August, and September) and the exports of wheat from the Gulf customs' districts (average for July, August, and September) is $r = +0.72 \pm 0.195$.

⁹ Heavy exports via the Gulf for a certain period might also be caused by changes in freight rates which would divert the traffic over another route. This evidently was not the cause of the variations.

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TABLE V

COMPARISON OF THE AVERAGE MONTHLY SPREADS WITH THE MONTHLY
MOVEMENT OF WHEAT FROM KANSAS CITY TO CHICAGO*

(January 1, 1924, to December 31, 1928)

Months	Movement of Wheat (Carloads)	May Spread	July Spread	September Spread	December Spread
<i>1924-25:</i>					
July.....	778	.....	.....	9.36	8.79
August.....	4,837	.....	.....	9.07	9.35
September.....	2,456	8.43	.....	7.19	8.81
October.....	917	8.49	.....	.....	8.85
November.....	231	9.06	7.42	.....	8.34
December.....	475	8.10	7.11	.....	7.75
January.....	115	9.12	8.60	.....	.....
February.....	89	10.86	9.94	8.02	.....
March.....	159	9.39	8.69	6.65	.....
April.....	79	6.09	7.24	5.89	.....
May.....	150	6.89	7.34	5.52	.....
June.....	133	.....	7.33	6.10	5.54
<i>1925-26:</i>					
July.....	147	.....	3.39	1.32	3.08
August.....	20	3.90	.....	0.83	1.95
September.....	50	1.86	.....	-2.89	-0.27
October.....	70	- 1.58	.....	.....	-4.37
November.....	12	0.53	5.02	.....	0.23
December.....	41	4.41	6.44	.....	3.57
January.....	37	4.50	7.26	.....	.....
February.....	51	5.83	7.85	.....	.....
March.....	43	7.03	8.00	6.96	.....
April.....	55	8.85	8.67	7.33	.....
May.....	289	8.86	8.77	7.52	.....
June.....	216	.....	9.62	8.02	.....
<i>1926-27:</i>					
July.....	421	.....	9.16	8.05	7.81
August.....	572	7.36	.....	7.02	6.98
September.....	249	6.95	.....	4.81	6.19
October.....	172	7.11	.....	.....	5.83
November.....	140	6.20	.....	.....	4.81
December.....	148	5.67	6.54	.....	3.97
January.....	66	6.17	6.76	.....	.....
February.....	96	7.52	7.67	.....	.....
March.....	119	7.14	7.43	.....	.....
April.....	146	6.53	7.39	6.97	.....
May.....	192	6.64	7.97	7.05	.....
June.....	445	.....	8.46	7.85	.....

* This table is significant in that it shows the tendency of the movement of wheat to increase at those times when the spread widens out to the point where it approaches the full shipping charge.

TABLE V—*Continued*

Months	Movement of Wheat (Carloads)	May Spread	July Spread	September Spread	December Spread
<i>1927-28:</i>					
July.....	1,019	.....	9.96	7.74	7.43
August.....	1,151	.....	.....	8.13	7.99
September.....	267	6.50	.....	5.37	6.37
October.....	188	6.28	.....	.....	5.28
November.....	196	6.10	.....	.....	4.46
December.....	189	6.00	.....	.....	4.67
January.....	121	5.60	5.91	.....	.....
February.....	91	6.33	6.80	.....	.....
March.....	222	8.14	8.29	.....	.....
April.....	243	8.05	9.15	.....	.....
May.....	149	3.15	8.70	8.58	.....
June.....	30	.....	7.16	8.12	.....
<i>1928-29:</i>					
July.....	143	.....	6.87	8.22	7.97
August.....	979	.....	.....	7.11	7.25
September.....	263	6.56	.....	5.62	6.25
October.....	219	6.27	.....	.....	5.79
November.....	162	6.44	.....	.....	6.01
December.....	67	6.69	.....	.....	7.11
January.....	59	7.21	7.56	.....	.....
February.....	429	8.12	8.56	.....	.....
March.....	287	7.74	8.67	.....	.....
April.....	197	7.29	7.55	.....	.....
May.....	80	5.67	6.70	8.06	.....
June.....	78	.....	6.59	8.03	.....

Since the coefficient of correlation is positive it would seem to indicate that the relationship between the two series is simply the reflection of a large crop in the Kansas City territory rather than the indication of an increased export demand.

APPENDIX

The present study, which deals with inter-market spreads in futures prices between Kansas City and Chicago, is based upon the assumption of comparable grades in the two markets. It is extremely difficult to make close price comparisons, market by market, either on the basis of cash or futures prices. A comparison of daily or weekly prices in any two given grain markets is commonly a comparison of two fairly wide daily or weekly ranges of prices. These two wide ranges of price may not represent changes in supply and demand but may represent differences in the qualities or varieties of the offerings in the different markets. Thus quotations in one market often represent transactions in a superior, and in the other, in an inferior or a different grade of the same commodity.¹

Inter-market spreads are somewhat more complicated when based upon futures prices than when based upon cash prices, since futures prices must be interpreted in terms of cash prices, and the two come together only during the months of delivery. The connection between two futures markets such as Kansas City and Chicago may be compared to a chain of three links. The middle link connects cash prices of comparable grades of wheat in the two markets (say the lowest quality, No. 2 hard winter wheat). At either end of this link is another link connecting the price of the cash wheat with the price of the May future. Each of the three links is elastic, with the lengths varying under the impact of a variety of influences, to some extent related, especially as regards the length of the two terminal links, and to a considerable extent independent.²

The question of deliverable grades enters in determining the length of the terminal links. It is the purpose of this section to discuss these grades and to show how one of the markets may at certain times be relatively higher or lower than the other because the two markets are not on a comparable basis.

It is quite common for the differences in deliverable grades to result in depression of the Chicago price relative to the Kansas City price. This may be explained as follows: only one class of wheat, hard winter, may

¹ Cf. Zapoleon, *op. cit.*, p. 432.

² See Personal letter on spreads, dated March 3, 1931, from Holbrook Working, Stanford University, California.

be delivered as contract wheat on futures contracts at Kansas City, while the number of different classes of wheat may be delivered on the Chicago contracts as contract grades. The basic grade in Kansas City is No. 2 hard winter, and the larger part of the deliveries will ordinarily be of this grade. During years of poor crops only a small percentage will grade No. 2, and many of the deliveries in Kansas City will consist of No. 3 hard winter which can be delivered on contracts at five cents below the contract price. During such years the deliveries will still be of hard winter even though not of the basic grade.

In Chicago, where a number of classes may be delivered on contract, the price of a class that is relatively scarce in a particular year is not fairly representative of the price of all wheat for that year, and the requirements for delivery on future contracts will take account of this situation, the result being the delivery of the tenderable class that is cheapest, grade for grade. During certain years there may be no deliveries of hard winter wheat on the futures contracts. If there is a scarcity of hard winter wheat it will probably be selling at a premium and the deliveries in Chicago will consist of other classes. Thus it may be that No. 1 northern spring will be the cheaper grade, and, since it can be delivered on contract in Chicago, the deliveries will be made of that class. Or it may be that some other class, accepted as a contract grade, will be the one that is delivered.

The effect of this upon the spread will be to depress the Chicago price relative to the Kansas City price by the amount of the premium on hard winter, while the spread between comparable grades of hard winter wheat in the two markets will remain wider than the actual spread quotations by the amount of the premium. If hard winter wheat is selling at two cents premium over the lowest contract grade that may be delivered in the Chicago market the spread between the prices of comparable grades of hard winter wheat in the two markets will be two cents wider than the quoted spread. If hard winter is lower in price than any of the other contract grades in the Chicago market it will be the one that is delivered in Chicago, and the two markets will be on a comparable basis with respect to deliverable grades.

Method of adjustment for deliverable grades.—It has been stated that the lowest priced variety of wheat will be delivered on futures contracts. This is true of both Kansas City and Chicago futures contracts. Hard winter wheat has been the basic grade deliverable in Kansas City since July 15, 1906. It was also deliverable in Chicago at two cents discount from some time in 1903 until October 1, 1908, after which it was deliver-

able as a basic grade without discount. Since October 1, 1908, the two markets have been on a comparable basis during those periods when the No. 2 hard winter is the lowest priced class deliverable in the Chicago market. When the No. 2 hard winter is at a premium over other deliver-

TABLE VI
KANSAS CITY-CHICAGO SPREADS FOR DELIVERABLE GRADES

Year	May Spread	May Spread Adjusted
1901-2.....	2.880	.....
1902-3.....	8.972	.....
1903-4.....	12.122	.....
1904-5.....	11.176	.....
1905-6.....	6.908	.....
1906-7.....	6.386	.....
1907-8.....	4.518	.....
1908-9.....	6.438	6.438
1909-10.....	5.205	5.275
1910-11.....	4.001	4.237
1911-12.....	1.851	1.851
1912-13.....	5.460	5.460
1913-14.....	5.229	5.228
1914-15.....	7.304	7.711
1915-16.....	6.935	7.935
1916-17.....	1.245	3.134*
1920-21.....	6.790	9.015*
1921-22.....	9.766	9.766
1922-23.....	7.770	6.843
1923-24.....	5.286	5.286
1924-25.....	8.492	9.542
1925-26.....	4.419	5.256
1926-27.....	6.729	9.254
1927-28.....	6.232	7.059
1928-29.....	6.887	6.887

* These two amounts are approximate.

able classes in the Chicago market, it is necessary to add the amount of the premium to the Chicago future price quotation, since the Chicago price quotation will be depressed relative to the Kansas City quotation on the basis of comparable deliverable grades.

The May spread between Kansas City and Chicago has been adjusted for the differences in deliverable grades for the series of years from 1908 to 1929 by determining the amount of the premium in the cash market of the hard winter over the lowest priced class deliverable on the Chicago

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contracts. The amount of this premium was determined by finding the differences in prices for the different varieties as shown in the *Annual Reports* of the Chicago Board of Trade. Monthly averages of these premiums were then computed and added to the annual monthly averages of the spreads in order to determine the monthly averages of the adjusted spread. Annual averages of the adjusted spread were then computed by averaging the monthly adjusted spreads. The adjusted annual averages are shown in Table VI.³

³ The actual spread was used for purposes of correlation instead of the adjusted spread, since the results obtained by the two methods did not differ greatly.